

DTC P207F or P20EE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provide an overview of each diagnostic category.

DTC Descriptors

DTC P207F

Incorrect Reductant Composition

DTC P20EE

NOx Catalyst Efficiency Below Threshold

Circuit/System Description

The ECM uses two nitrogen oxide (NOx) sensors to control exhaust NOx levels. The NOx sensor measures the amount of NOx and oxygen in the exhaust system. The first NOx sensor is located at the outlet of the turbocharger and monitors the engine out NOx. The second NOx sensor is located between the selective catalytic reduction (SCR) and the diesel particulate filter (DPF) that monitors NOx levels exiting the SCR. The engine control module (ECM) varies the amount of diesel exhaust fluid (DEF) or reductant added by varying the reductant injector duty cycle in response to changes in engine exhaust out NOx levels.

Conditions for Running the DTC

- The BARO pressure is greater than 75 kPa (11 psi).
- The ambient air and reductant temperatures are warmer than -7°C (19°F) and the reductant tank is not in frozen tank status.
- The engine speed is between 1,000–3,000 RPM.
- The average SCR temperature is between $240\text{--}290^{\circ}\text{C}$ ($464\text{--}564^{\circ}\text{F}$).
- The emission reduction fluid tank level is above 33 %.
- The battery voltage is greater than 11 V for more than 3 s.
- The engine run time is greater than 10 s.
- Vehicle is not in a DPF regeneration.
- Engine on time must be less than 25 minutes.
- The DTCs run once per drive cycle when the above conditions are met.

Conditions for Setting the DTC

P207F

The ECM has determined the incorrect reductant composition.

P20EE

The ECM has determined the catalyst efficiency has degraded below a calibrated threshold.

Action Taken When the DTC Sets

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DTC P207F and P20EE are Type B DTCs.

Conditions for Clearing the DTC

DTC P207F and P20EE are Type B DTCs.

Diagnostic Aids

- Using fuel other than ultra low sulfur content fuel will cause this DTC to set.
- A quality message may be present on the Driver Information Center (DIC) with or without DTCs P20EE or P2BAD.
- A leak in the reductant system can be located by inspecting for a build-up of crystallized diesel exhaust fluid (DEF).
- Water in the reductant tank will cause this DTC to set. Multiple Reductant Fluid Quality tests will be necessary to heal the system once the DEF fluid is replaced with fresh reductant.
- During a DPF service regeneration, the SCR is too hot to reduce NOx effectively. NOx sensor 1 and NOx sensor 2 values should be relatively similar. NOx sensor 2 can be up to 30% higher than NOx sensor 1 in some cases.
- During a road test at operating temperature and highway speeds, the NOx sensor 2 should be 70% less than the NOx sensor 1 and transition in the same direction as the upstream sensor, but at a much lower magnitude. During a road test, you can collect transient data for NOx sensor 1 and NOx sensor 2. After a heavy acceleration followed by a tip out (zero pedal input), both sensors should go to zero while coasting down. If NOx sensor 2 does not go to zero shortly after NOx sensor 1, NOx sensor 2 is either faulty or the system is saturated with reductant. Performing this test during or shortly after a DPF regeneration prevents the system from being saturated with reductant.
- The NOx sensors cannot distinguish between NOx and liquid reductant. High NOx sensor 2 readings can be caused by reductant getting past the SCR catalyst. This can be the result of a degraded catalyst or a condition that causes excessive reductant on the SCR. After a DPF service regeneration, the SCR system is purged of excessive reductant. It is easier to evaluate if an SCR is compromised right after a service regeneration because it eliminates the extra reductant that the system was exposed to.
- It is recommended that the following parameters are recorded every 2 minutes during and after each Reductant Fluid Quality Test and DPF Service Regeneration for reference as they may become necessary:
 - NOx Sensor 1 NOx Concentration
 - NOx Sensor 2 NOx Concentration
 - EGT Sensor 1
 - EGT Sensor 2
 - EGT Sensor 3
 - EGT Sensor 4

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

- Diesel Exhaust Fluid (DEF) Warning Strategy

- [Exhaust Aftertreatment System Description](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTCs P0101, P0191, P0400, P0401, P0402, P0420, P1043, P1044, P1048, P1049, P11CB, P11CC, P11DB, P11DC, P140B, P140C, P202E, P2047, P2048, P2049, P204B, P204C, P204D, P204F, P205B, P205C, P025D, P208A, P208B, P208D, P20A0, P20A2, P20A3, P20E8, P20E9, P2200, P2201, P2202, P2203, P2205, P2209, P229E, P229F, P22A0, P22A1, P22A3, P22A7, P2413, PC29D, or PC29E are not set.
 - ⇒ **If any of the DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).
 - ↓ **If none of the DTCs are set**
3. Verify none of the conditions listed below do not exist with the diesel oxidizing catalyst or NOx sensors, selective catalytic reduction system and DPF:
 - Physical damage or alterations
 - Internal rattles caused by a damaged catalyst substrate
 - Exhaust system leaks—Refer to [Exhaust Leakage](#).
 - Loose B195 NOx sensors or B131 Exhaust Gas Temperature Sensors—Refer to [DTC P229E](#).
 - ⇒ **If a condition is exists**
Repair as necessary.
 - ↓ **If no condition exists**
4. Verify the reductant is not contaminated. Refer to [Contaminants-in-Diesel Exhaust Fluid Diagnosis](#).
 - ⇒ **If contaminated**
Repair as necessary.
 - ↓ **If not contaminated**
5. Verify the fuel is not contaminated or the fuel quality is poor—Refer to [Contaminants-in-Fuel Diagnosis](#).
 - ⇒ **If contaminated or poor quality**
Repair as necessary.
 - ↓ **If not contaminated or poor quality**
6. Ignition ON.
7. Command the Reductant System Leak Test ON with a scan tool. Allow the pressure to build for at least 2 minutes. The first 60 s, the system performs a system purge.

8. Verify there are no leaks in the reductant lines.
 - ⇒ **If a condition is found**
Repair as necessary.
 - ↓ **If no condition is found**
9. Verify the scan tool Reductant Pressure sensor parameter is between 400–650 kPa (58–94 psi).
 - ⇒ **If not between 400–650 kPa (58–94 psi)**
Refer to [DTC P208B](#).
 - ↓ **If between 400–650 kPa (58–94 psi)**
10. Remove the Q61 Emission Reduction Fluid Injector from the exhaust pipe leaving the reductant line and electrical connector connected. Place the injector into a suitable container.
11. Verify the [Emission Reduction Fluid Injector Quantity Test](#) passes when commanded ON with a scan tool.
 - ⇒ **If the test does not pass**
Repair as necessary
 - ↓ **If the test passes**
12. Verify none of the conditions listed below exist:
 - Leaking Q57 Indirect Fuel Injector—Refer to [Exhaust Aftertreatment Fuel Injector Diagnosis](#).
 - Leaking fuel injectors—Refer to [Fuel Injector Balance Test with Tech 2](#).
 - Engine oil consumption—Refer to [Oil Consumption Diagnosis](#).
 - Engine coolant consumption—Refer to [Coolant in Combustion Chamber](#).
 - Engine mechanical condition—Refer to [Symptoms - Engine Mechanical](#).
 - ⇒ **If a condition exists**
Repair as necessary.
 - ↓ **If no condition exists**
Note: The reductant fluid quality test may need to be performed 3 times to complete the following steps.
13. Verify the [Reductant Fluid Quality Test](#) passes when commanded ON with a scan tool.
 - ⇒ **If the first test failed**
 - 13.1. Perform the [Diesel Particulate Filter \(DPF\) Service Regeneration](#) with a scan tool.
 - ⇒ **If the Service Regeneration fails**
 - 13.1.1. Verify the scan tool EGT Sensor 3 and EGT Sensor 4 is between 450–700°C (842–1292°F).
 - ⇒ If less than 450°C (842°F) or greater than 700°C (1292°F), verify the conditions listed below do not exist and repair as necessary:
 - 13.1.2. Intake system leaks—Refer to Induction System Smoke Test and Full System Air Leak Test in [Charge Air Cooler Diagnosis](#).
 - 13.1.3. High sulfur content fuel
 - ↓ If between 450–700°C (842–1292°F)
Note:
The EGT temperatures should stabilize during the service regeneration.
The Q57 Indirect Fuel Injector is located in the right bank exhaust pipe downstream from the turbocharger and before the DOC.
Do not record EGT temperatures after the service regeneration fails, only record EGT temperatures during an active regeneration.

- 13.1.4. Verify the scan tool EGT 1 and EGT 2 temperature difference is within 100°C (180° F).
- ⇒ If EGT 2 is not within 100°C (180° F) of EGT 1, test the Q57 Indirect Fuel Injector flow. Refer to Exhaust Aftertreatment Fuel Injector Diagnosis and repair as necessary.
 - ↓ If EGT 2 is within 100°C (180° F) EGT 1
- 13.1.5. Verify the scan tool EGT 2 and EGT 4 temperature difference is within 100°C (180° F).
- ⇒ If EGT 4 is not greater than EGT 2 by more than 100°C (180° F), test the Q57 Indirect Fuel Injector flow. Refer to Exhaust Aftertreatment Fuel Injector Diagnosis and repair as necessary.
 - ↓ If EGT 4 is greater than EGT 2 by more than 100°C (180° F), idle engine for 15 min.
- 13.1.6. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down.
- 13.1.7. Clear the DTCs.

Note:

A service regeneration will not run if DTC P0420 is set, only an on road driving regeneration.

DTC P0420 is not active during the service regeneration therefore there will be no stored EGT Freeze Frame data stored in the scan tool. The DTC only runs during a driving regeneration.

When EGT temperatures are recorded during the service regeneration, the EGT temperatures must be recorded during the regeneration and prior to the service regeneration failing.

- 13.1.8. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
- ⇒ If the DTC sets and EGT 4 is greater than EGT 2 by more than 100°C (180° F), replace the diesel oxidation catalyst
 - ↓ If the DTC does not set and EGT 4 is not greater than EGT 2 by more than 100°C (180° F)
- 13.1.9. Proceed to the road test portion of the diagnostic

↓ **If the Service Regeneration passes**

Warning: Road test a vehicle under safe conditions and while obeying all traffic laws. Do not attempt any maneuvers that could jeopardize vehicle control. Failure to adhere to these precautions could lead to serious personal injury and vehicle damage.

Note: Do not turn the ignition off prior to performing the following Reductant Fluid Quality Test.

13.2. Drive the vehicle for 25 min.

13.3. Repeat the Reductant Fluid Quality Test in the previous step.

⇒ **If the second test failed**

Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Immediately following the key cycle, repeat the Reductant Fluid Quality Test in the previous step, for a third time.

⇒ **If the third test failed**

13.1. Drive the vehicle and perform a heavy acceleration followed by a zero throttle deceleration.

13.2. Verify the scan tool parameters listed below return to less than 10 ppm.

- NOx Sensor 1 NOx Concentration
- NOx Sensor 2 NOx Concentration

⇒ If 10 ppm or greater, replace the appropriate B195 Nitrogen Oxide Sensor.

⇒ If less than 10 ppm, replace the DPF.

↓ **If the first test passes**

14. All OK.

Repair Instructions

- [Catalytic Converter Replacement for DOC](#)
- [Emission Reduction Fluid Exhaust Front Pipe Injector Supply Pipe Replacement](#)
- [Emission Reduction Fluid Injector Replacement](#)
- [Emission Reduction Fluid Tank Replacement](#)
- [Exhaust Particulate Filter Replacement for SCR/DPF](#)
- [Nitrogen Oxides Sensor Replacement - Position 1](#)
- [Nitrogen Oxides Sensor Replacement - Position 2](#)
- Perform the scan tool reset procedures after replacing the reductant or any other components not including the SCR/DPF:
 1. Clear the DTCs.
 2. NOx Catalyst Reductant Loading Reset.
 3. [Emission Reduction Fluid Injector Quantity Test](#).

Note: The diesel exhaust fluid (DEF) must be greater than -7°C ($+19^{\circ}\text{F}$) and not in frozen tank status before proceeding with this procedure.
 4. Verify the [Reductant Fluid Quality Test](#) passes when commanded ON with a scan tool. This test is necessary to verify system efficiency.

⇒ **If the test does not pass**
A condition with the system still exists.

↓ **If the test passes**
- 5. All OK.
- Perform the scan tool reset procedures after replacing the SCR/DPF:
 1. Clear the DTCs.
 2. NOx Catalyst Reductant Loading Reset
 3. NOx Catalyst Reset
 4. DPF/Catalyst 2 Reset
 5. Perform the [Diesel Particulate Filter \(DPF\) Service Regeneration](#) to break in the SCR/DPF.
 6. Verify the [Reductant Fluid Quality Test](#) passes when commanded ON with a scan tool. This test is necessary to verify system efficiency.

⇒ **If the test does not pass**
A condition with the system still exists.

↓ **If the test passes**
 7. All OK.

Repair Verification

1. Install any components or connectors that have been removed or replaced during diagnosis.

2. Perform any adjustment, programming, or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Ignition OFF, all vehicle systems OFF, this may take up to 2 minutes.
Note: The diesel exhaust fluid (DEF) must be greater than -7°C ($+19^{\circ}\text{F}$) and not in frozen tank status before proceeding with this procedure.
5. Ignition ON.
6. Verify there are no leaks in the system when commanding the Reductant System Leak Test ON with a scan tool.
⇒ **If a leak is found**
Repair as necessary
↓ **If no leak is found**
7. All OK.